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## Angiogenic factors.

**Folkman J, Klagsbrun M.**

Within the past 2 years, several angiogenic factors have been fully purified, their amino acid sequences determined, and their genes cloned. These polypeptides include acidic and basic fibroblast growth factor, angiogenin, and transforming growth factors alpha and beta. Other less well characterized angiogenesis factors have also been isolated, some of which are lipids. This article traces the discovery of the angiogenic factors and describes their possible significance in understanding growth regulation of the vascular system. When evaluated according to their putative targets, they appear to fall into two groups: those that act directly on vascular endothelial cells to stimulate locomotion or mitosis, and those that act indirectly by mobilizing host cells (for example, macrophages) to release endothelial growth factors. In addition to their presence in tumors undergoing neovascularization, the same angiogenic peptides are found in many normal tissues where neovascularization is not occurring. This suggests that physiological expression of angiogenic factors is tightly regulated. In addition to the persistent angiogenesis induced by tumors, it now appears that a variety of nonneoplastic diseases, previously thought to be unrelated, can be considered as "angiogenic diseases" because they are dominated by the pathologic growth of capillary blood vessels.

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